

a chemical mechanical polishing pad having a plurality of reliefs with a bottom surface disposed in a predetermined pattern thereon, wherein the predetermined pattern is configured to indicate a wear of at least one region of the pad with respect to a pad radius.

13²⁴. The apparatus of claim 23, wherein the predetermined pattern is configured to enable monitoring of the pad wear to discern whether two or more regions of the pad are wearing at different rates.

14²⁵. The apparatus of claim 23, wherein the predetermined pattern is selected from inline, spiral, non-symmetrical pseudo-random, and combinations thereof.

REMARKS

This is intended as a full and complete response to the Office Action dated October 25, 2002, having a shortened statutory period for response set to expire on January 25, 2003. Please reconsider the claims pending in the application for reasons discussed below.

Claims 5-13 and 21-25 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Tzeng*, U.S. Patent No. 5,934,974, (*Tzeng*) in view of *Raeder, et al.*, U.S. Patent No. 6,331,137, (*Raeder*). The Examiner asserts it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the in-situ monitoring system of *Tzeng* by providing the polishing pad with patterned openings as taught by *Raeder*. The Applicants respectively traverse the rejection.

Raeder discloses a polishing pad having openings that vary with depth so that the surface area of the polishing pad varies as the pad wears. Every embodiment taught by *Raeder* has openings with at least two different depths, such as in Figures 4, 6, 8, 10, 14 and 15. In fact, *Raeder's* claimed invention teaches X openings located at a first depth and Y openings located at a second depth. *Raeder* does not relate to measuring the depth of the openings to determine pad wear. For these reasons, a

person skilled in the art would not be motivated to combine the teachings of *Raeder* and *Tzeng*. Therefore, the rejection is improper and the claims are allowable.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the method or apparatus of the present invention. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

5. (Amended) A method for measuring wear of the thickness of a chemical mechanical polishing pad, the method comprising:

providing a plurality of reliefs having a bottom surface in a main polishing surface of the pad; and

measuring a distance from the main polishing surface to [a] the bottom surface of each of [a] the plurality of [the] reliefs, wherein the plurality of reliefs are disposed in a predetermined pattern such that the wear of the pad is determinable as a function of pad radius.

7. (Amended) A method for measuring wear of the thickness of a chemical mechanical polishing pad, comprising:

providing a plurality of reliefs having a bottom surface in a main polishing surface of the pad, the reliefs being disposed in a predetermined pattern;

measuring a distance by laser from the main polishing surface to [a] the bottom surface of each of [a] the plurality of [the] reliefs, wherein the pad has a radius; and

determining wear of the pad as a function of the pad radius, based on the [relief] predetermined pattern and the measured distances, to generate a pad wear profile.

8. (Amended) A method for measuring wear of the thickness of a chemical mechanical polishing pad, comprising:

providing a plurality of reliefs having a bottom surface in a main polishing surface of the pad, the plurality of reliefs being disposed in a predetermined pattern;

measuring a distance by laser from the main polishing surface to [a] the bottom surface of each of [a] the plurality of [the] reliefs; and

determining a wear rate of a first portion of the main polishing surface of the pad based on the [relief] predetermined pattern and the measured distances.

21. (Amended) An apparatus for chemical mechanical polishing a substrate comprising,

a chemical mechanical polishing pad having a plurality of reliefs having a bottom surface in a main polishing surface for determining wear of the pad, wherein the reliefs comprise through-holes in the pad or extend partially through a thickness of the pad; and

means for measuring a distance from the main polishing surface to [a] the bottom surface of each of the plurality of reliefs.

23. (Amended) An apparatus for chemical mechanical polishing a substrate comprising,

a laser probe; and

a chemical mechanical polishing pad having a plurality of reliefs with a bottom surface disposed in a predetermined pattern thereon, wherein the predetermined pattern is configured to indicate [the] a wear of at least one region of the pad with respect to [the] a pad radius.